

Developing a Brief Problem Gambling Screen Using Clinically Validated Samples of At-Risk, Problem and Pathological Gamblers

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Abstract

Screening for problem gambling takes place in both clinical settings and in population research. Several short assessment tools for problem gambling have been developed over the past decade for use in these settings. However, the performance of all of these brief screens has been assessed in relation to the longer screens from which they are derived. The purpose of the present study is to identify a subset of items taken from **all** of the most widely-used problem gambling screens that is effective in capturing the large majority of **clinically-assessed** at-risk, problem and pathological gamblers. A secondary goal is to examine the performance of existing short screens in correctly identifying clinically assessed individuals.

The present study uses data collected in two surveys that included all of the most widely used problem gambling screens and classified respondents based on clinical assessments. The sample includes over 7,000 North American gamblers. The 30 unique problem gambling items were sorted into three dimensions (gambling motivations, behaviors and consequences) and the items most closely correlated with the clinically-assessed At-Risk, Problem and Pathological Gamblers in the two surveys and capturing 50% or more of the Pathological Gamblers and 5% or less of the Recreational Gamblers were identified.

Once the candidate items in the two surveys were identified, the performance of all two-item, three-item, four-item and five-item combinations was examined to assess capture rates in each sample. All combinations that captured 98% of the Pathological Gamblers, 94% of the Problem Gamblers and 80% of the At-Risk Gamblers were considered eligible for further investigation. This consisted of determining the classification accuracy of the most promising combinations of items. Each of the promising combinations was then further examined for its performance across gender, age and ethnicity to assess the level of measurement invariance associated with each combination.

Based on performance across both surveys and measurement invariance across major demographic groups, a combination of five items including one motivation item, three behavior items, and one consequences item was identified as the best brief screen for clinically-assessed at-risk, problem and pathological gambling. In contrast, the performance of item combinations that best represented other brief problem gambling screens developed in recent years was unsatisfactory. This underscores the importance of assessing the performance of brief screens in relation to clinical assessments rather than in relation to the longer screens from which they are derived.

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Introduction

Screening for problem gambling takes place in both clinical settings and in population research. However, the challenges related to screening for problem gambling in these different settings are distinct. The challenge in clinical settings is that existing problem gambling screens are, in general, too long to consider for routine use in intake interviews. Whether in primary health settings or in substance abuse and mental health treatment facilities, practitioners are generally coping with people in immediate need of care. Screening for problem gambling in such situations using any of the standard screens—which typically include between 10 and 20 items—can seem inappropriate and burdensome.

The challenge in population research is the relative infrequency of problem and pathological gambling in general population samples. This generally means survey researchers must administer problem gambling screens to very large numbers of respondents to identify adequate numbers of problem and pathological gamblers for statistical analysis. Another challenge in population research is that existing problem gambling screens are relatively lengthy, which can become onerous for individuals who gamble very little. The need to include very large samples in population studies of problem gambling means that the costs for such studies are high while the length of problem gambling screens leads to lower response rates and can raise questions about the validity of the results.

One solution to the challenges in both clinical settings and population research is to identify a small subset of items that efficiently identifies the large majority of individuals who would be positively identified using longer problem gambling screens while yielding minimal loss of cases as false negatives. In the alcohol field, there are now a number of brief screening tools that employ subsets of items from longer, standardized assessments (Bush, Kivlahan, McConell, Fihn, & Bradley, 1998; Cherpitel, 2002; Cherpitel, Ye, Moskalewicz, & Swiatkiewicz, 2005; Dawson, Grant, Stinson, & Zhou, 2005; Pokorny, Miller, & Kaplan, 1972). Similarly, short screens have been found as effective as longer screening measures in initial screening for depression in clinical and population settings (U. S. Preventive Services Task Force, 2002).

Review of Existing Screens

Several short assessment tools for problem gambling have been developed over the past decade. There are drawbacks as well as advantages associated with each of these brief screens. In this section, we review the development and performance of the majority of these short problem gambling screens. While there are several ways such a review could be organized, we have chosen to consider the various measures in the chronological order of their development.

The EIGHT Screen

The earliest short screen for problem gambling was developed by Sullivan (1999) for use in primary care and clinical settings. The EIGHT Screen was intended to serve as a filter for further screening or a clinical interview. Items for the screen were selected from existing screens, including the South Oaks Gambling Screen (SOGS; Lesieur & Blume (1987)), the DSM-IV criteria (American Psychiatric Association, 1994) and the Gamblers Anonymous 20 Questions (GA-20). Validation involved administering a list of 35 items to problem gamblers in treatment and to non-problem gamblers in a community sample. Analysis showed that eight of these items were able to differentiate problem gamblers from non-problem gamblers on the basis of their SOGS score. Based on the SOGS, a cutoff score of four on the EIGHT Screen was found to maximize sensitivity and specificity of the test. The EIGHT Screen demonstrated acceptable internal consistency and test-retest reliability. The EIGHT Screen has a simple scoring format and has been used in primary health care, prisons and other settings in New Zealand (Delfabbro & LeCouteur, 2003). One significant concern is that the EIGHT Screen is almost as long as the nine-item Problem Gambling Severity Index (PGSI; Ferris & Wynne (2001)) and some DSM-IV based measures, suggesting that it might be better to use these latter measures from the outset.

The Lie-Bet Screen

The Lie-Bet Screen consists of two items extracted from the DSM-IV with a dichotomous (yes-no) response format (Johnson et al., 1997). The two questions that make up the screen focus on experiencing tolerance (“Have you ever felt the need to bet more and more money?”) and lying to others (“Have you ever had to lie to people important to you about how much you gambled?”). The Lie-Bet Screen was derived from a 12-item scale based on the DSM-IV criteria that was administered to 191 members of Gamblers Anonymous and 171 employees of a Veterans Administration Medical Center. The authors used discriminant analysis to identify the items that best differentiated between the two groups. Further validation with 146 problem gamblers and 277 controls was carried out in a subsequent study (Johnson, Hamer, & Nora, 1998).

Despite impressive psychometric results in its initial development, the Lie-Bet Screen has not been widely used. An exception is the first national prevalence surveys of adolescents and adults conducted in Norway (Götestam, Johansson, Wenzel, & Simonsen, 2004). Noting the need for a rapid screening tool for pathological gambling, the Norwegian researchers examined the performance of the Lie-Bet Screen in large adult and adolescent general population samples in Norway. While the items performed poorly as a screen for pathological gambling *per se*, a positive response to one or both items did perform well with respect to the detection of individuals with DSM-IV scores of 3 or more. The Lie-Bet Screen correctly detected over 90% of DSM-IV defined problem and pathological gamblers (11 of 12 adults; 180 of 194 adolescents).

There were also 146 people incorrectly classified as having problems (false positives). With respect to screening, if administration of the full screen was confined to people in the Norwegian prevalence surveys who scored positive on the Lie-Bet Screen, only 196 people would have needed to be assessed fully at the cost of missing 15 people with problems. As Neal, Delfabbro and O'Neil (2005) note in relation to the Lie-Bet Screen, the search for a very efficient surrogate for longer scales is a worthwhile endeavour. Clearly, further investigation of the Lie-Bet Screen in other settings and in relation to other measures is warranted.

The CHAT Problem Gambling Screen

In New Zealand, Goodyear-Smith and colleagues (2004) included a single item within a longer lifestyle screening tool to screen for gambling problems ("Have you sometimes felt unhappy or worried after a session of gambling?"). The initial study was followed by another study validating the entire lifestyle screening tool, now dubbed the Case-finding and Help Assessment Tool (CHAT) in a sample of primary care patients (Goodyear-Smith et al., 2008). In this study, the researchers added a second gambling question ("Does gambling sometimes cause you problems?") and compared the rate at which participants answered yes to either question to their classification based on the South Oaks Gambling Screen. While the specificity of the two-item screen in relation to the SOGS was high (97%), sensitivity was only 88% indicating that 12% of those with potential gambling problems went undetected. While the CHAT questions represent a promising step in opportunistically screening for problem gambling, screening for problem gambling in clinical populations such as primary care patients requires an instrument that is more sensitive to gambling problems and has been psychometrically tested in relation to the most current diagnostic criteria for pathological gambling.

Reduced SOGS Measure

In a recent review, Abbott and Volberg (2006) concluded that the high level of correlation amongst all of the existing problem gambling measures suggests that consideration should be given to further refinement of the SOGS, including retention of the better performing items and removal of those that have become obsolete or fail to reflect problems in some groups.

One research team in the U.S. has already undertaken work in this direction. Strong et al. (2004) used item response theory to identify a reduced set of items from the SOGS that performs well in both community and clinical samples. The researchers initially identified a subset of 15 items from the original SOGS that demonstrated significant stability across community and clinical samples and a good relationship to the DSM-IV criteria in the clinical sample. In a subsequent study, Strong et al. (2003) again used Rasch modelling to identify a subset of six items from the original SOGS that predicted problem gambling severity equally well in a large sample of U.S. college students and in a separate sample of treatment-seeking pathological gamblers. While potentially quite useful, this shortened version of the SOGS

consists of one highly subjective item (“Did you ever gamble more than you intended to?”) and five items that address financial issues. This set of items ignores other personal and social factors associated with an individual’s ability to control their gambling.

The NODS-CLiP

In 2002, several colleagues at the National Opinion Research Center at the University of Chicago (including Dr. Volberg) embarked on a program of research to create a brief screen for problem gambling. The focus at that time was on improving the efficiency of population research methods for identifying problem gamblers using items derived from a validated DSM-IV screen (Gerstein, Volberg, Harwood, & Christiansen, 1999). The NORC DSM-IV Screen for Gambling Problems (NODS) is a structured 17-item screen originally developed for use in a U.S. national epidemiological and policy study (Gerstein et al., 1999). Prior to deployment in the main study, the NODS was tested for reliability and validity with a sample of individuals recently enrolled in gambling treatment programs in several states as well as with a random sample of adults from the Chicago metropolitan area. Since its development, the NODS has been used by researchers throughout North America in both population research and in treatment studies (Hodgins, 2002, 2004; Sartor et al., 2007; Volberg, Nysse-Carris, & Gerstein, 2006; Wickwire, Burke, Brown, Parker, & May, 2008; Wulfert et al., 2005; Xian et al., 2008).

Following development of the NODS, Toce-Gerstein, Gerstein and Volberg (2009) used data from eight population surveys that included the screen to identify a subset of questions to which 99% of the NODS-classified pathological gamblers and 94% of the NODS-classified problem gamblers answered at least one in the affirmative. This new screen was dubbed the NODS-CLiP to remind users of the three criteria assessed using this screen (Loss of **Control**, **Lying** and **Preoccupation**). While just as sensitive to problem and pathological gambling in population surveys as the full 17-item NODS, the NODS-CLiP by itself was not deemed to have adequate specificity to be used as a stand-alone screen in population research. The developers recommended that individuals who endorsed one or more of the NODS-CLiP items be administered the remaining items that make up the NODS to confirm or disconfirm a potential diagnosis of pathological gambling.

In a subsequent analysis of data from a large prevalence survey in California (Volberg et al., 2006), two additional items that significantly improved the capture rate of individuals who score as At-Risk Gamblers on the full NODS were identified. In the California sample, adding items that assess **Chasing** and **Escape** to the original NODS-CLiP increased the capture rate for At-Risk gamblers from 43% to 89% as well as improving capture rates for problem gambling and pathological gambling (from 93% and 99% respectively to 100% in both cases) without adding to the capture rate for non-problem gamblers. This version of the screen, dubbed the NODS-

CLiP2, was included in the 2008 prevalence survey in Victoria, Australia (Victoria Office of Gaming and Racing, 2009).

The NODS-PERC

In 2007, Volberg and two colleagues received funding from the Ontario Problem Gambling Research Centre to investigate whether the NODS-CLiP performed as well in clinical settings as in general population samples (Volberg, Munck, & Petry, 2008). The sample for this study included participants in two studies of brief interventions for problem and pathological gambling carried out at the University of Connecticut Health Center and funded by the National Institutes of Health (Petry, Weinstock, Ledgerwood, & Morasco, 2008; Petry, Weinstock, Morasco, & Ledgerwood, 2009).

While the focus of the study was on testing the performance of the NODS-CLiP in a clinical sample, the research team chose to investigate a broader range of combinations of items from the NODS rather than assume that the original brief screen was the best performer in a clinical setting. While the NODS-CLiP performed well in the clinical sample in terms of capturing pathological and problem gamblers, the screen over-captured individuals in the sample who scored as low-risk gamblers. An alternative combination of four items (**Preoccupation, Escape, Risked Relationships** and **Chasing** or PERC) was equally effective at capturing pathological gamblers and somewhat better at capturing problem gamblers in the clinical sample. The four-item combination also performed better in terms of not capturing individuals in the clinical sample who scored as problem gamblers on the SOGS but not on the NODS. The improved specificity of the four-item combination contributed to higher diagnostic efficiency of the four-item combination compared with the NODS-CLiP. The research team concluded that the NODS-PERC performed better in settings where the base prevalence of pathological gambling is extremely high while the NODS-CLiP was preferred in situations where the base prevalence rate is low (Volberg, Munck, & Petry, in press).

The Brief Biosocial Gambling Screen (BBGS)

Most recently, Gebauer, LaBrie and Shaffer (2010) analyzed data from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), a large general household population survey, to develop a brief three-item screen for pathological gambling. The Brief Biosocial Gambling Screen (BBGS) is made up of items that assess past-year experiences of **Withdrawal, Deception** and **Bailout**. The brief screen demonstrated high sensitivity and specificity in relation to the longer 15-item screen representing the operationalized DSM-IV criteria for pathological gambling that was included in NESARC (Petry, Stinson, & Grant, 2005). The developers of the BBGS argue that the brevity of the screen and its strong theoretical foundation, including as it does one item from each of the three domains of the addiction

syndrome (neuroadaptation, psychosocial characteristics and adverse consequences), should encourage clinicians and epidemiologists to use it alongside screens for other problems.

One critical weakness in the development of the BBGS is the lack of published information about the clinical validity or diagnostic reliability of the lengthier DSM-IV gambling module developed for NESARC, against which the BBGS is benchmarked. While the research team that carried out NESARC did complete a test-retest study of the reliability of the full instrument used in the survey, the retest sample did not include any pathological gamblers. This precluded any assessment of the performance of the gambling module (Grant et al., 2003). As far as we are aware, there was no effort to validate the pathological gambling module against a sample of diagnosed individuals as was done during the development of the NODS (Gerstein et al., 1999).

Methods

One of the limitations of the research described above is that each of the existing short screens is derived from a single instrument and each is validated only against this same instrument. Although there is a fair degree of correspondence between the classifications obtained with different problem gambling assessment instruments (Abbott & Volberg, 2006; Neal, Delfabbro, & O'Neil, 2005; Stinchfield, Govoni, & Frisch, 2007), there are also some differences. Hence, it is unknown whether the same degree of correspondence and overlap occurs with these short screens. Similarly, it is unknown whether a selection of questions from different instruments might produce a more robust short screen with good sensitivity and specificity across all of the major problem gambling instruments.

A second, even more important limitation is that all of these short screens are validated against instruments, which themselves, have only modest correspondence to the classifications obtained in direct clinical assessments (see Williams & Volberg, 2010 for a review). Thus, the actual sensitivity and specificity of these short screens relative to **clinical assessment** is unknown, but will certainly be significantly lower than their established sensitivity and specificity against the longer instruments from which they are derived.

Hence, the primary purpose of the present study is to identify a subset of items taken from **all** of the most widely-used problem gambling screens that is effective in capturing the large majority of **clinically-assessed** at-risk, problem and pathological gamblers. A secondary goal is to examine the performance of existing short screens – including the Lie-Bet screen, the NODS-CLiP and the BBGS – in correctly identifying the large majority of clinically assessed individuals. The work reported here is intended to lay the foundation for a full-scale test of the validity, reliability and classification accuracy of the new set of items.

The present study represents an intersection of separate research programs developed by the two principal investigators. The first program focused on developing a brief problem gambling screen while the second program sought to identify “best practices” in the population assessment of gambling and problem gambling. The present study uses data collected in two surveys that included all of the most widely used problem gambling screens (SOGS, PGSI, NODS and PPGM¹) as well as clinical assessments of each respondent’s problem gambling status. Together, these studies include 7,273 gamblers of whom 522 were classified as “pathological gamblers,” 455 were classified as “problem gamblers,” 2,030 were classified as “at risk gamblers” and 4,266 were classified as “recreational gamblers.”

¹ The Problem and Pathological Gambling Measure (PPGM) is a new measure under development by Dr. Williams (reported in Williams & Volberg, 2010).

Our approach is similar to the approach taken in earlier studies of the NODS-CLiP and its variations (Toce-Gerstein et al., 2009; Volberg et al., 2008, in press). However, rather than examine the performance of various combinations of items in relation to the NODS, we have used the clinical assessments that formed part of our Best Practices study as well as Dr. Williams' Internet study as the "gold standard" against which to judge the performance of several different brief screens.

Sample

Best Practices Study

A sample of 3,028 adults was surveyed by the Survey Research Centre (SRC) at the University of Waterloo between January 2008 and April 2008. The study was conducted in the Kitchener Census Metropolitan Area (CMA) in Ontario, Canada for two reasons. The first was to create a small enough geographic region to make a door-to-door survey logistically feasible. The second was to ensure a good base rate of problem gambling since the Kitchener CMA had one of the highest rates of problem gambling in Ontario in the CCHS 1.2 survey (3.6% compared to 2.0% for the rest of Ontario; Rush, Adlaf, Veldhuizen, Corea, & Vince, 2005).

The sample was selected in one of two ways. The majority of respondents (71%) were randomly selected from Census Dissemination Areas (DA) having a higher than average prevalence of people aged 20 – 29, as this is the age group that generally has the highest rate of problem gambling. The remaining respondents came from a random selection of areas of two-kilometer diameter within the Kitchener CMA. Within each of these circumscribed geographic areas, a comprehensive listing of listed phone numbers that had accompanying addresses was compiled. These listings were randomly assigned to either telephone recruitment or door-to-door recruitment. Within each modality, the sample was then randomly assigned to receive either a "gambling" or "health and recreational activities" description of the survey (even though the surveys were otherwise identical).

The interviewee was randomly determined by requesting the interview be conducted with the adult (18 and over) in the household having the most recent birthday. If this person was not available, the person having the last birthday was interviewed. If this person was not available, the person answering the door was interviewed. There were only three attempts to interview someone in the household due to the logistical costs involved in returning to the person's house for a face-to-face survey. Although additional contact attempts could have been made for the telephone surveys, this was not done in order to keep the sampling procedure as similar as possible to the face-to-face protocol.

Internet Online Survey

The Internet Study included two separate surveys: a random digit dial telephone survey and an online self-administered survey of 12,521 adults from 105 countries, conducted from June to December 2007. People from 105 different countries participated in the Online Survey with the primary countries being: United States (76.3%); Canada (9.6%); United Kingdom (3.3%); Italy (0.7%); Australia (0.5%); New Zealand (0.4%); Ireland (0.4%); Argentina (0.3%); Germany (0.3%); Finland (0.3%); France (0.3%); Israel (0.3%); Singapore (0.3%); and South Africa (0.3%).

Only respondents from the United States and Canada were included in the present study in the interests of aligning the sample as closely as possible with the Best Practices sample. For the same reason, a small number of respondents under the age of 18 (N=8) was excluded from the analysis.

Participants in the Internet Online Survey were recruited at a prominent gambling web-portal that provides a comprehensive listing of Internet and land-based gambling sites as well as links to gaming news and publications and a gaming business directory. Advertising space was purchased on the web-portal and two different banner links were placed on the portal from June through December 2007. In total, the banner links were shown 2 million times over the 6-month time span. The banner links contained the University of Lethbridge logo, along with professionally designed graphics and captions that would appeal to gamblers (“Test your gambling knowledge; take the University of Lethbridge Survey”, and “See how your gambling knowledge, attitudes and behavior compare to other people”). Clicking the link directed participants to a homepage for the online questionnaire. At the questionnaire homepage, participants were able to choose from seven languages (English, French, German, Italian, Spanish, Mandarin, and Japanese). Translations of the questionnaire were all done by professional translating services. Having selected a language, participants were then presented with an informed consent preamble (including purpose of the study, the voluntary nature of participation, and guarantees of anonymity). A “cookie” was built into the survey so that those who attempted to take the survey multiple times were politely denied access and reminded that they had already completed the survey. This online recruitment protocol was approved by the University of Lethbridge research ethics committee.

Problem Gambling Assessment

In both the Best Practices and the Internet Online surveys, all respondents who reported any past year gambling participation were asked a series of questions covering the signs, symptoms and correlates of problem gambling. The questions consisted of the 30 unique items that comprise the South Oaks Gambling Screen (SOGS) (Lesieur & Blume, 1987), the NORC DSM-IV Screen for Gambling Problems (NODS) (Gerstein et al., 1999), the problem gambling severity section of the Canadian Problem Gambling Index (CPGI) (Ferris & Wynne, 2001) and the

Problem and Pathological Gambling Measure (PPGM) (Williams & Volberg, 2010). All of the problem gambling items used a past-year time frame. The purpose of administering all four screens was to comprehensively ask all questions potentially relevant for the clinical assessment of problem gambling in our clinical assessment procedure (see below).

The original intent in both studies was to fully randomize the order of the four instruments so that, once a question was asked, its equivalent question in the other scale(s) was not asked (and the answer to equivalent questions was automatically inserted in the other scales). While there are differences in the specific wording of similar items from different screens, we felt it was preferable to present the actual questions from whichever screen was presented first rather than attempt to draft intermediate question wording for these items. Another challenge in this process is that the CPGI items have four response options while the other three scales all offer only two response options to each question. Rather than lose information specific to the CPGI items, we elected to always administer the CPGI items first with the other three screens randomly rotated.

Information about the problem gambling items in the two surveys, including content areas, source of items, and labels, is presented in Appendix A.

Sample Characteristics

Before proceeding, it is helpful to consider the demographic characteristics of the two samples. The following table shows that the Internet Online sample is significantly older and more likely to be male than the Best Practices sample. The Best Practices sample also includes significantly larger proportions of European/Caucasian and Asian respondents than the Internet Online sample. The table also shows that the clinically-assessed prevalence of problem and pathological gambling is significantly higher in the Internet Online sample compared with the Best Practices sample.

Table 1: Demographic Characteristics of the Two Samples

	Internet Online (N=4449)	Best Practices (N=3028)
Male	61.7	44.7
Female	38.3	55.3
18 – 24	3.3	23.2
25-44	23.4	37.3
45 and over	73.2	39.5
European/Caucasian	73.1	78.9
Asian	2.3	9.7
Other	20.8	11.0

	Internet Online (N=4449)	Best Practices (N=3028)
Non-Gambler	2.7	27.6
Recreational	45.8	62.2
At Risk	34.9	8.4
Problem	8.1	1.2
Pathological	8.5	0.6

Clinical Assessment

Problem gambling classifications in both the Best Practices Study and the Internet Online Survey were subject to a clinical assessment procedure. In gambling research, the way in which this has traditionally been done is to compare classifications obtained from the problem gambling instruments against classifications based on clinical interviews done by telephone several months later (i.e., Ferris & Wynne, 2001; Ladouceur et al., 2000; Murray, Ladouceur, & Jacques, 2005). While this strategy has merit, it also has some problems:

- Problem gambling has some inherent temporal instability (e.g., Abbott, Williams, & Volberg, 2004; Slutske, Jackson, & Sher, 2003; Wiebe, Single, & Falkowski-Ham, 2003). For example, the original test-retest reliabilities of the SOGS and CPGI were only .71 and .78 respectively (Ferris & Wynne, 2001) (the DSM-IV tends to be higher).
- Problem gambling may be minimized in the subsequent clinical interview because of social desirability biasing. In contrast to the initial assessment, participants are no longer anonymous and may feel “targeted” because of their earlier report of problems and the fact they are now being re-interviewed by a professional clinician. Additionally, people who are repeatedly assessed tend to report lower rates of clinical problems so as to convey improvement, independent of whether improvement has actually occurred (e.g., Fendrich, Mackesy-Amiti, Wislar, & Goldstein, 1997; Jorm, Duncan-Jones, & Scott, 1989).
- The standard test-retest approach creates potential sampling problems, as a significant proportion of people decline to be reassessed or cannot be recontacted. In general, hard-to-contact participants tend to have higher rates of pathology compared to easy-to-contact participants (e.g., Stinchfield, Niforopulos, & Feder, 1994).
- Clinical telephone assessments are typically done by a single clinician, and usually in an unstructured way. Thus, there is no guarantee that the interview covers all areas relevant to the determination of problem gambling, or that the clinician is objectively applying accepted criteria for the determination.

A growing body of research suggests that, in general, it is a mistake to use unstructured subjective clinical judgment as a “gold standard” since it is usually less accurate than simple actuarial formulas or assessment instruments (Dawes, Faust, & Meehl, 1989; White et al., 2006). Clinicians have superior ability to integrate information and to see connections and inconsistencies. However, this advantage only manifests itself in superior diagnostic accuracy when clinicians are required to follow explicit and rigorous assessment procedures that minimize subjectivity and require attention to all relevant information (e.g., Gambrill, 2006).

Hence, it seems clear that instrument validation is best done by using a **comprehensive** set of **concurrently** obtained information from **all participants**, and that **more than one clinician** should be involved in the assessment by rigorously applying **explicit and widely accepted criteria for the determination**.

The optimal situation would be to have a group of clinicians conducting the initial prevalence survey so they could immediately engage in supplementary questioning of anyone who reports any signs or symptoms of problem gambling. Unfortunately, this is cost prohibitive when thousands of people are being surveyed. However, a reasonable compromise is to:

- Ask all participants an exhaustive list of questions that inquire about the “universe” of potentially relevant signs, symptoms, and correlates of problem gambling.
- Have two experienced clinicians independently examine this comprehensive set of information for each individual and clinically assess the person’s appropriate gambling categorization using widely accepted definitions of “problem” and “non-problem” gambling (with all cases lacking unanimity being jointly reviewed to obtain a consensus judgment).

Of the 3,028 individuals in the Best Practices data set, 607 were selected for Clinical Assessment based on having one or more positive responses to any of the problem gambling questions and/or reporting more than \$49/month in gambling losses. All the rest were designated as either Recreational Gamblers or Non-Gamblers (if no gambling in past 12 months was reported). Of the 12,521 individuals in the Internet Online data set, a total of 5,301 individuals completed all sections of the survey, thus allowing for a comprehensive profile of their gambling behavior, problem gambling symptomatology, and demographics. Of these 5,301 individuals, 3,464 people were selected for Clinical Assessment based on having one or more positive responses to any of the problem gambling questions and/or having more than \$49/month in gambling losses. All the rest were designated as either Recreational Gamblers or Non-Gamblers (if no gambling in past 12 months was reported).

A research assistant created a one page profile of each individual selected for clinical assessment. These profiles provided:

- A detailed report of the person's past year gambling behavior (frequency of each type; spending on each type; total frequency; total spending).
- The person's answer to each of the problem gambling questions from the CPGI, SOGS, NODS, and PPGM (38 questions if including the sub-questions of the SOGS). Questions from each instrument were mixed together, no summary scores for any scale were provided, and the scale origin of each question was not identified.
- Answers to questions about lifetime history of problem gambling, help-seeking for gambling problems, third-party beliefs about the person's gambling, and the types of gambling causing the most problems.
- Verbatim answers to open-ended questions posed to individuals to explain either their (a) problem gambling designations in the absence of significant past year money expenditures or, (b) very high past year money expenditures in the absence of a problem gambling designation (Best Practices only).
- Answers and scores on the validity questions (Best Practices only).
- Answers to questions about substance use and mental health issues (Internet Online only).
- Relevant demographic characteristics (age, marital status, employment, past year income, current debt).

In total, the Best Practices profile provided answers to 95 questions posed to the participants and the Internet Online provided answers to 104 questions.

These 4,071 profiles were then given to two experienced clinicians (one psychiatrist and one psychologist). Over a period of several months, these clinicians independently read each of the profiles and assessed the person's gambling status. Any cases where there was disagreement were collectively resolved (an intraclass correlation coefficient of .973 was obtained between the two clinicians). The choices available to them were Recreational Gambler, At Risk Gambler, Problem Gambler, and Pathological Gambler. A detailed written definition of each of these categories was provided to guide the clinical assessments (see Appendix B). These definitions were derived from the literature and refined based on feedback the authors received from international gambling experts in the United States, Canada, and Sweden.

Analytic Approach

As noted above, the present study involves secondary analysis of data from two existing studies using an approach previously developed to identify brief screens for problem gambling in different settings (Toce-Gerstein et al., 2009; Volberg et al., 2008, in press).

The large number of problem gambling items included in the Best Practices and Internet Online surveys poses a challenge in terms of the potential number of combinations to be considered. Rather than examine every possible combination, we adopted an approach similar to that taken by the developers of the BBGS (Gebauer et al., 2010) and limited our consideration of item combinations to those that assessed different dimensions of problem gambling.

One way to reduce the number of potential combinations is to conduct a factor analysis of the items to determine their underlying dimensionality. Principle components analysis of the Internet Online data yielded a single factor with an eigenvalue of 10.0 that accounted for 33% of the variance and an additional five factors with eigenvalues of 1.0 or higher that accounted for an additional 22% of the variance. Twenty-two of the items loaded significantly on the first factor while two other items loaded significantly on the fifth factor. Rotated factor solutions with five, four and three factors yielded a first factor that included all but one of the CPGI items and one SOGS item, a second factor consisting of items related to a loss of control over gambling, and additional factors composed of varying mixes of consequences arising from gambling involvement. Our concern with using the factor structure to dimensionalize the problem gambling items was that the heavy loading of the CPGI items on the first factor might be due to an ordering effect since these items were always presented first in the administration of the surveys.

Rather than rely strictly on the factor analysis, we divided the 30 problem gambling items into three groups assessing gambling motivations, gambling behavior and consequences. Gambling **motivations** relate to internal psychological states, such as preoccupation with gambling and gambling to escape uncomfortable feelings. Gambling **behaviors** relate to gambling participation, such as needing to gamble with larger amounts to get the same excitement or making attempts to cut down, control or stop gambling. Gambling **consequences** arise from problematic gambling participation and include feeling guilty about one's gambling or borrowing money to gamble or pay gambling debts. The principal investigators independently assigned each item to one of the three dimensions and all cases that did not agree were jointly reviewed to obtain a consensus assignment.

Information on the dimensionality of the items assessed in the two surveys is presented in Appendix C. From this table, it is clear that the majority of items from the most widely-used problem gambling screens assess gambling consequences (N=17) or gambling behaviors (N=10). Only three items assess gambling motivations.

The next step in the analysis was to examine the correlation coefficients for each item in the two samples in relation to the clinical assessments. We generated Pearson correlation coefficients based on the full gambling categorization rather than coding the At-Risk, Problem

and Pathological Gamblers into one group. We took this approach because we were interested in whether items were differentially correlated with the different categories of gamblers.

This approach was useful in providing an initial indication of which items were most closely correlated with the clinically-assessed At-Risk, Problem and Pathological Gamblers and therefore most likely to perform well in capturing substantial numbers of these individuals in each sample. The following table presents the top ten ranked items in each sample. The table shows that while SOGS4 is the top-ranked item in both samples, there are substantial differences in the ranking of items in the two surveys. It is worth noting that SOGS4 inquires about gambling more than intended; this is the one non-financial question included in the reduced set of SOGS items identified by Strong and colleagues (Strong et al., 2003).

Table 2: Rank Order of Items Correlated with Problem Gambling Status

Rank	Internet Online	Best Practices
1	SOGS4	SOGS4
2	CPGI6	PPGM8C
3	CPGI9	PPGM10
4	CPGI1	CPGI9
5	PPGM8C	CPGI4
6	CPGI2	PPGM2
7	CPGI3	CPGI8
8	PPGM2	CPGI3
9	CPGI5	CPGI2
10	SOGS9	SOGS12

The next step in the analysis was to examine the proportion of each clinically-assessed group in the two surveys that endorsed each of the problem gambling items. After running frequencies to determine overall item endorsement rates, all of the problem gambling items were cross-tabulated with the clinical taxonomy to determine which items captured the highest proportion of Pathological Gamblers in each sample. All items that captured 50% or more of the Pathological Gamblers and less than 5% of the Recreational Gamblers were considered eligible

candidates for further analysis.² This step in the analysis reduced the number of items for consideration to 19 in the Internet Online sample and to 18 in the Best Practices sample.

The following table presents the candidate items in each sample, sorted by dimension. Twelve items, highlighted in red, were common to both the Internet Online and the Best Practices samples. Preference in the subsequent analyses was given to these items in order to develop a brief screen that would operate effectively across both samples.

Table 3: Candidate Items for Each Sample by Dimension

Internet Online			Best Practices		
Motivation	Behavior	Consequence	Motivation	Behavior	Consequence
PPGM10	CPGI3	CPGI5	PPGM10	CPGI3	CPGI2
NODS5A	SOGS4	CPGI6		CPGI4	CPGI5
NODS5B	SOGS7	CPGI7		SOGS4	CPGI6
	SOGS8	CPGI8		PPGM8C	CPGI7
	PPGM8C	CPGI9		PPGM9	CPGI8
	PPGM8D	SOGS9			CPGI9
		PPGM2			SOGS9
		PPGM4			SOGS12
		PPGM12			PPGM2
		NODS7			PPGM6
					PPGM7
					NODS7

Once the best candidate items in the two surveys were identified, the performance of combinations of items was examined to assess their capture rates in each sample. All

² Readers may wonder why we did not narrow down the candidate list by identifying items that captured 50% of all of the At-Risk, Problem and Pathological Gamblers. Examination of item endorsement rates showed that At-Risk and Problem Gamblers endorsed every item at far lower rates than Pathological Gamblers. Our focus on Pathological Gamblers yielded more items for consideration in the analysis than would have been the case otherwise.

combinations that captured 98% of the Pathological Gamblers, 94% of the Problem Gamblers and 80% of the At-Risk Gamblers were considered eligible for further investigation. This consisted of determining the classification accuracy of the most promising combinations of items. Each combination was then further examined for its performance across gender, age and ethnicity to assess the level of measurement invariance associated with each combination of items.

A separate but important step in the analysis was to examine the performance of item combinations that best represent other brief problem gambling screens that have been developed in recent years. The following table presents these screens along with the items used to construct them in the present analysis.

Table 4: Constructing Other Brief Problem Gambling Screens

Brief Screen	Items
Lie-Bet Screen	CPGI3 + NODS7
NODS-CLiP	NODS1A + NODS3A + NODS7
NODS-CLiP2	NODS1A + NODS3A + NODS7 + NODS5A + CPGI4
NODS-PERC	NODS1A + NODS5A + SOGS9 + CPGI4
BBGS	PPGM9 + NODS7 + NODS10

Results

Endorsement of Individual Items

We begin by considering the rates at which the individual problem gambling items were endorsed in the two surveys. The following table presents endorsement rates for the 12 items that were endorsed by 50% or more of the Pathological Gamblers and less than 5% of the Recreational Gamblers in the two surveys. Given the differences in problem gambling prevalence in the two samples, it is not surprising that endorsement rates for individual items are substantially lower in the Best Practices sample compared with the Internet Online sample.

Table 5: Endorsement of Problem Gambling Items

	Internet Online (N=4449)	Best Practices (N=3028)
CPGI3/NODS2/PPGM11	19.3	2.0
CPGI5//PPGM1A/ NODS10	9.4	1.5
CPGI6/PPGM1B	12.0	0.9
CPGI7	11.2	1.2
CPGI8/SOGS5	16.5	1.8
CPGI9/SOGS3	19.6	1.5
SOGS4/PPGM8A	35.2	4.2
SOGS9/NODS9A/PPGM3A	6.5	0.8
PPGM2	6.6	1.2
PPGM8C/NODS3A	18.2	3.8
PPGM10/NODS1A+B	13.0	2.1
NODS7	11.2	1.3

Although endorsement rates for individual items are much lower among the Best Practices respondents compared with the Internet Online respondents, the following table shows that the rank order of the top six items is nevertheless quite similar across the two samples.

Table 6: Rank Order of Items in the Two Samples

	Internet Online (N=4449)	Best Practices (N=3028)
SOGS4/PPGM8A	1	1
CPGI9/SOGS3	2	6
CPGI3/NODS2/PPGM11	3	4
PPGM8C/NODS3A	4	2
CPGI8/SOGS5	5	5
PPGM10/NODS1A+B	6	3
CPGI6/PPGM1B	7	11
NODS7	8	8
CPGI7	9	9

	Internet Online (N=4449)	Best Practices (N=3028)
CPGI5//PPGM1A/ NODS10	10	7
PPGM2	11	10
SOGS9/NODS9A/PPGM3A	12	12

Endorsement of Individual Items by Gender, Age and Ethnicity

There are well-known differences in problem gambling prevalence by gender, age and ethnicity. In developing a brief screen for problem gambling in population research, it is important to select items that capture problem gamblers from different demographic groups equally well. A critical step in selecting potential items is to examine differences in endorsement rates for individual items by important demographic groups. The following table presents endorsement rates for the 12 candidate items in the two samples by gender.

Table 7: Endorsement of Items by Gender

	Internet Online		Best Practices	
	Male (N=2724)	Female (N=1690)	Male (N=1353)	Female (N=1674)
CPGI3/NODS2/PPGM11	17.8	21.7*	3.2	1.0*
CPGI5//PPGM1A/ NODS10	8.8	10.6*	2.1	0.9*
CPGI6/PPGM1B	9.9	15.6*	1.0	0.7*
CPGI7	10.2	13.0*	1.8	0.7*
CPGI8/SOGS5	15.3	18.8*	2.9	0.8*
CPGI9/SOGS3	16.9	24.1*	2.1	1.0*
SOGS4/PPGM8A	31.9	41.3*	6.9	2.0*
SOGS9/NODS9A/PPGM3A	6.5	6.8	1.3	0.4*
PPGM2	6.0	7.5*	1.8	0.6*
PPGM8C/NODS3A	15.9	22.7*	5.6	2.2*
PPGM10/NODS1A+B	13.8	12.1	3.1	1.3*
NODS7	9.8	13.6*	2.3	0.5*

*Pearson Chi-square, $df=2, p < .01$

The table shows that there are significant differences in endorsement rates by gender for all but two of the items in the Internet Online sample and for all of the items in the Best Practices sample. Men and women in the Internet Online sample are equally likely to endorse SOGS9 which asks about arguments over handling money; while men are more likely than women to endorse PPGM10 which asks about preoccupation with gambling, the difference is not statistically significant. One striking difference between the two samples is that women in the Internet Online sample are more likely than men in the same sample to endorse all of the

problem gambling items except PPGM10 while women in the Best Practices sample are less likely than men in the same sample to endorse any of the candidate items.³

The next table presents endorsement rates for the candidate items by age groups in the two samples. Readers are reminded that the Internet Online sample includes a preponderance of adults aged 45 and over while the Best Practices sample includes a much larger proportion of respondents under the age of 25.

Table 8: Endorsement of Items by Age

	Internet Online			Best Practices		
	18 – 24 (N=148)	25 – 44 (N=1030)	45 & over (N=3236)	18 – 24 (N=1809)	25 – 44 (N=563)	45 & over (N=588)
CPGI3/NODS2/PPGM11	31.8	21.2	18.1*	2.4	2.1	0.5
CPGI5//PPGM1A/ NODS10	17.8	12.4	8.2*	1.7	1.4	1.0
CPGI6/PPGM1B	14.3	16.3	10.7*	0.8	1.1	0.9
CPGI7	16.2	15.6	9.7*	1.3	1.4	1.0
CPGI8/SOGS5	39.9	21.5	14.0*	1.8	2.0	1.5
CPGI9/SOGS3	33.3	21.4	18.5*	1.5	1.4	1.7
SOGS4/PPGM8A	38.8	36.9	34.9*	4.9	3.7	2.7
SOGS9/NODS9A/PPGM3A	19.7	9.9	5.0*	0.8	0.9	0.9
PPGM2	14.3	8.9	5.5*	1.3	0.9	1.2
PPGM8C/NODS3A	26.5	20.4	17.5*	4.4	3.2	2.4
PPGM10/NODS1A+B	26.7	17.6	11.1*	1.8	2.8	2.4
NODS7	24.3	13.9	9.8*	1.6	1.2	0.7

*Pearson Chi-square, df=4, $p < .01$

The table shows that there are significant differences in endorsement rates by age group for all of the items in the Internet Online sample. Respondents under the age of 25 in the Internet Online sample are significantly more likely to endorse all of the problem gambling items compared with adults aged 45 and over. In most cases, endorsement rates among respondents aged 25 to 44 are intermediate between those of the younger and older respondents. In contrast to the Internet Online sample, there are no significant differences in endorsement rates by age group in the Best Practices sample.

Finally, the following table presents endorsement rates of the candidate items across ethnic groups in the two samples. Among the Internet Online respondents, Europeans are significantly less likely than Asian respondents or those classified as “Other” to endorse any of the problem gambling items. Endorsement rates for all of the candidate items are highest among Internet Online Asian respondents. Among the Best Practices respondents, Asians are

³ One possibility that women who access an online gambling portal have more severe gambling problems than men because online gambling is more normative for men than for women.

significantly more likely to endorse CPGI3 which asks about needing to gamble with larger amounts to get the same excitement as well as CPGI5 which asks about borrowing money or selling personal property to get money for gambling.

Table 9: Endorsement of Items by Ethnicity

	Internet Online			Best Practices		
	European (N=3224)	Asian (N=102)	Other (N=917)	European (N=1188)	Asian (N=148)	Other (N=148)
CPGI3/NODS2/PPGM11	18.8	36.3	22.5*	1.6	3.4	1.4*
CPGI5//PPGM1A/ NODS10	8.0	22.5	14.8*	1.0	3.4	1.4*
CPGI6/PPGM1B	10.3	26.3	19.0*	0.3	1.4	1.4
CPGI7	10.5	20.0	14.9*	0.7	2.0	0.7
CPGI8/SOGS5	15.5	31.4	21.7*	1.3	1.4	2.0
CPGI9/SOGS3	18.2	35.0	26.7*	0.8	2.0	2.0
SOGS4/PPGM8A	35.3	47.0	41.2*	3.5	4.1	4.1
SOGS9/NODS9A/PPGM3A	5.3	19.0	11.3*	0.5	---	---
PPGM2	5.9	14.9	9.5*	0.8	0.7	2.0
PPGM8C/NODS3A	16.8	29.0	26.6*	2.9	5.4	5.4
PPGM10/NODS1A+B	12.7	21.4	16.1*	1.3	1.4	2.0
NODS7	10.6	20.0	14.9*	1.2	0.7	1.4

*Pearson Chi-square, df=4, $p < .01$

Identifying the Best Performing Items

Before examining combinations of problem gambling items, we consider the performance of the individual items.

The table on the following page presents endorsement rates for all of the candidate items among the clinically-assessed groups of Pathological, Problem, At-Risk and Recreational Gamblers in the two surveys. It is clear from this table that no single item captures adequate proportions of At-Risk, Problem and Pathological Gamblers to perform alone as a brief screen. The item that comes closest in the Internet Online sample is SOGS4 which asks about gambling more than intended. While 91% of the Internet Online Pathological Gamblers endorse this item, only 83% of the Best Practices Pathological Gamblers endorse this item. PPGM10, which asks about preoccupation with gambling, is the most frequently endorsed item among the Best Practices Pathological Gamblers. While 89% of Pathological Gamblers in the Best Practices sample endorse this item, only 68% of the Internet Online Pathological Gamblers endorse PPGM10.

Table 10: Endorsement Rates for Single Items

	Internet Online			
	Recreational (N=2036)	At Risk (N=1550)	Problem (N=361)	Pathological (N=380)
CPGI3/NODS2/PPGM11	0.1	29.2	30.5	76.7
CPGI5//PPGM1A/ NODS10	---	4.7	3.3	59.1
CPGI6/PPGM1B	---	4.5	52.9	72.7
CPGI7	1.3	8.8	26.3	64.0
CPGI8/SOGS5	3.6	16.7	34.6	72.8
CPGI9/SOGS3	2.2	21.5	48.9	84.3
SOGS4/PPGM8A	0.1	60.3	80.8	91.3
SOGS9/NODS9A/PPGM3A	---	2.2	15.6	52.6
PPGM2	---	1.8	12.3	57.7
PPGM8C/NODS3A	0.4	22.8	44.9	77.8
PPGM10/NODS1A+B	---	16.9	16.5	68.3
NODS7	1.3	9.3	28.5	58.8
	Best Practices			
	Recreational (N=1884)	At Risk (N=255)	Problem (N=36)	Pathological (N=18)
CPGI3/NODS2/PPGM11	---	14.9	33.3	55.6
CPGI5//PPGM1A/ NODS10	---	9.0	30.6	55.6
CPGI6/PPGM1B	---	4.7	11.1	55.6
CPGI7	0.1	5.1	30.6	61.1
CPGI8/SOGS5	0.6	5.9	47.2	55.6
CPGI9/SOGS3	0.2	5.5	41.7	72.2
SOGS4/PPGM8A	---	33.3	77.8	83.3
SOGS9/NODS9A/PPGM3A	---	2.7	19.4	55.6
PPGM2	---	5.5	22.2	72.2
PPGM8C/NODS3A	0.9	23.9	61.1	77.8
PPGM10/NODS1A+B	---	15.3	27.8	88.9
NODS7	0.4	3.9	27.8	66.7

Endorsement Rates for Other Brief Screens

The next step in our analysis is to examine the performance of other brief problem gambling screens in relation to the clinically-assessed groups in the two surveys. The following table presents capture rates for item combinations that represent the closest approximation in the Internet Online and Best Practices data sets to existing brief problem gambling screens. Earlier in this report, we provided information about the specific items included in these constructed variables (see Table 4 on Page 17).

Table 11: Endorsement Rates for Other Brief Screens

	Internet Online			
	Recreational (N=2017)	At Risk (N=1538)	Problem (N=358)	Pathological (N=379)
Lie-Bet Screen	1.4	33.5	47.6	87.9
BBGS	1.3	15.7	54.6	86.3
NODS-CLiP	1.7	38.8	64.8	95.0
NODS-CLiP2	18.4	63.4	83.1	97.4
NODS-PERC	17.3	53.7	71.2	95.5
	Best Practices			
	Recreational (N=1884)	At Risk (N=255)	Problem (N=36)	Pathological (N=18)
Lie-Bet Screen	0.4	18.4	50.0	77.8
BBGS	0.4	14.1	52.8	88.9
NODS-CLiP	1.3	38.0	80.6	100.0
NODS-CLiP2	4.2	50.2	88.9	100.0
NODS-PERC	3.1	38.0	72.2	100.0

The table shows that capture rates for several of the brief screens reviewed in this report are disappointingly low in relation to the clinical assessments. The NODS-CLiP and its two variations, the NODS-CLiP2 and the NODS-PERC, do the best job of capturing Pathological Gamblers, Problem Gamblers and At-Risk Gamblers in both the Internet Online and the Best Practices samples. However, both the NODS-CLiP2 and the NODS-PERC capture relatively large proportions of Recreational Gamblers, particularly in the Internet Online sample, which significantly reduces their classification accuracy. None of the brief screens capture more than 89% of the Problem Gamblers or more than 50% of the At-Risk Gamblers.

Identifying the Best Performing Combinations of Items

In this section, we examine the performance of numerous combinations of problem gambling items to identify the smallest set of items that captures the largest proportions of Pathological, Problem and At-Risk Gamblers in the two surveys.

Two-Item Combinations

We look first at the performance of the 35 different two-item combinations that can be created by pairing items from the three different dimensions. The one Motivation item (PPGM10) can be paired with the three Behavior items and the eight Consequences items to produce 11 combinations. The three Behavior items can be paired with the eight Consequences items to produce 24 additional combinations.

Among the Internet Online respondents, none of the combinations capture 98% or more of the Pathological Gamblers although several combinations capture 95% or more of the group. All of these combinations include SOGS4 in combination with either the one Motivation item (PPGM10) or one of the Consequences items. Two of these combinations also capture 90% or more of the Problem Gamblers and three other combinations capture more than 85% of the Problem Gamblers. All of these combinations capture 60% or more of the At-Risk Gamblers and all of them also capture small numbers of the Recreational Gamblers.

Among the Best Practices respondents, several two-item combinations capture all of the Pathological Gamblers. These combinations include PPGM10 and SOGS4, SOGS4 and CPGI9, and PPGM8C and both PPGM2 and NODS7. The first two combinations also capture 83% of the Problem Gamblers while the second two combinations capture 67% and 75% of the Problem Gamblers, respectively. The highest capture rate for At-Risk Gamblers among these combinations is PPGM10 and SOGS4 which captures 47% of the At-Risk Gamblers. This combination does not capture any Recreational Gamblers in contrast to the other combinations which capture small numbers of respondents in this group.

The following table presents the most promising two-item combinations from the Internet Online and Best Practices samples. Combinations that are common across the two surveys are highlighted in red.

Table 12: Capture Rates for Two Item Combinations

	Internet Online			
	Recreational (N=2017)	At Risk (N=1538)	Problem (N=358)	Pathological (N=379)
PPGM10 + SOGS4	0.1	68.7	83.7	96.6
SOGS4 + CPGI5	0.1	64.1	86.1	95.5
SOGS4 + CPGI6	0.1	63.5	91.4	96.1
SOGS4 + CPGI7	1.4	63.9	86.4	95.3
SOGS4 + CPGI8	3.6	66.5	87.8	97.9
SOGS4 + CPGI9	2.3	66.8	90.0	97.4
SOGS4 + SOGS9	0.1	61.7	84.5	95.8
SOGS4 + PPGM2	0.1	61.3	83.1	95.5
SOGS4 + NODS7	1.4	62.5	83.9	95.8
	Best Practices			
	Recreational (N=1884)	At Risk (N=255)	Problem (N=36)	Pathological (N=18)
PPGM10 + SOGS4	---	46.7	83.3	100.0
PPGM10 + SOGS9	---	17.6	44.4	100.0
PPGM10 + PPGM2	---	19.6	47.2	100.0
SOGS4 + CPGI9	0.2	38.0	83.3	100.0

	Best Practices			
PPGM8C + PPGM2	0.9	29.0	66.7	100.0
PPGM8C + NODS7	1.3	25.5	75.0	100.0

Three-Item Combinations

Next, we look at the performance of the many three-item combinations that can be created by pairing the single Motivation item, the three Behavior items and the eight Consequences items. Given the importance of maintaining dimensionality in the brief screen, we looked first at combinations that include the single Motivation item (PPGM10) along with one Behavior item and one Consequences item. However, to be thorough, we also looked at combinations of one Behavior item with two Consequences items and two Behavior items with one Consequences item. Finally, we looked at combinations that included only three Behavior items or three Consequences items.

Among the Internet Online respondents, only the three-dimension, three-item combinations that include PPGM10 and SOGS4 capture 98% of the Pathological Gamblers and none capture more than this proportion. Two of the PPGM10 and SOGS4 combinations also capture more than 90% of the Problem Gamblers and all of the combinations that included PPGM10 and SOGS4 capture 70% or more of the At-Risk Gamblers although none capture more than 75% of these respondents.

Among the three-item combinations that include one Behavior item and two Consequences items, the SOGS4 group is again the most promising among the Internet Online respondents. None of the combinations of CPGI3 or PPGM8C with two Consequences items capture 98% or more of the Pathological Gamblers while 13 of the combinations that included SOGS4 and two Consequences items capture 98% of the Pathological Gamblers. However, only one combination of SOGS4 and two Consequences items (CPGI6 and CPGI9) captures 95% of the Problem Gamblers. Among the three-item combinations that include two Behavior items and one Consequences item, the SOGS4 and PPGM8C group is the most promising. Only one combination of SOGS4 and the other Behavior item, CPGI3, captures close to 99% of the Pathological Gamblers although this combination does capture the largest proportion of At-Risk Gamblers (78%). Two combinations of SOGS4 and PPGM8C with a Consequences item (CPGI8 and CPGI9) capture 99% of the Pathological Gamblers and 95% or more of the Problem Gamblers in the Internet Online sample.

Considering item combinations from a single dimension, none of the combinations of three Consequences items perform satisfactorily. However, the combination of three Behavior items captures nearly 99% of the Pathological Gamblers and more than 95% of the Problem Gamblers. This combination also captures 80% of the At-Risk Gamblers.

Among the Best Practices respondents, numerous three-dimension, three-item combinations capture 100% of the Pathological Gamblers. However, capture rates for Problem and At-Risk Gamblers are unsatisfactory for all of the three-dimension, three-item combinations since none of these captures more than 92% of the Problem Gamblers or more than 55% of the At-Risk Gamblers. Among the three-item combinations that include one Behavior item and two Consequences items, 38 combinations capture all of the Pathological Gamblers and four of these combinations also capture 94% or more of the Problem Gamblers. However, none of these combinations capture more than 45% of the At-Risk Gamblers. The three-item combinations that include two Behavior items and one Consequences item perform better in the Best Practices sample, with five combinations of SOGS4 and PPGM8C with one Consequences item capturing all of the Pathological Gamblers, 97% of the Problem Gamblers and more than 50% of the At-Risk Gamblers. Finally, as in the Internet Online sample, none of the combinations of three Consequences items perform well but the combination of three Behavior items captures all of the Pathological Gamblers and 94% of the Problem Gamblers.

The following table presents the most promising three-item combinations from the two samples. Combinations that are common across the two surveys are highlighted in red.

Table 13: Capture Rates for Three Item Combinations

	Internet Online			
	Recreational (N=2017)	At Risk (N=1538)	Problem (N=358)	Pathological (N=379)
PPGM10 + SOGS4 + CPGI6	0.1	71.6	93.9	98.7
PPGM10 + SOGS4 + CPGI8	3.6	72.9	88.6	98.7
PPGM10 + SOGS4 + CPGI9	2.3	74.0	91.4	98.4
SOGS4 + CPGI6 + CPGI9	2.3	68.8	95.0	98.2
SOGS4 + CPGI9 + SOGS9	2.3	68.1	92.8	98.9
CPGI3 + SOGS4 + CPGI8	3.7	78.0	90.9	98.9
SOGS4 + PPGM8C + CPGI8	3.9	73.7	98.3	99.5
SOGS4 + PPGM8C + CPGI9	2.6	73.0	96.4	99.2
CPGI3 + SOGS4 + PPGM8C	0.6	80.5	97.0	98.9
	Best Practices			
	Recreational (N=1884)	At Risk (N=255)	Problem (N=36)	Pathological (N=18)
SOGS4 + PPGM8C + CPGI5	0.9	57.6	97.2	100.0
SOGS4 + PPGM8C + CPGI7	1.0	52.9	97.2	100.0
SOGS4 + PPGM8C + CPGI8	1.5	51.8	97.2	100.0
SOGS4 + PPGM8C + SOGS9	0.9	52.5	97.2	100.0
SOGS4 + PPGM8C + PPGM2	0.9	55.3	97.2	100.0
CPGI3 + SOGS4 + PPGM8C	0.9	59.2	94.1	100.0

Four-Item Combinations

We now turn to examine the performance of the numerous four-item combinations that can be created using the single Motivation item, the three Behavior items and the eight Consequences items. Again, with our interest in maintaining dimensionality in the brief screen, we looked first at combinations that include the single Motivation item (PPGM10) along with one Behavior item and two Consequences item. We then looked at combinations that included the single Motivation item, two Behavior items and one Consequences item. We also looked at combinations that included two Behavior items and two Consequences items, those that included one Behavior item and three Consequences items and, finally, at combinations that include three Behavior items and one Consequences item.

Among the Internet Online respondents, eight of the four-item combinations of one Motivation item, one Behavior item and two Consequences items capture 99% of the Pathological Gamblers and four of the combinations capture 95% or more of the Problem Gamblers. Capture rates for At-Risk Gamblers range from 72% to 77% and all of these combinations include SOGS4 rather than one of the other two Behavior items. Four of the four-item combinations of one Motivation item, two Behavior items and one Consequences item capture 99% or more of the Pathological Gamblers and two of these combinations capture 98% of the Problem Gamblers. The highest capture rate for At-Risk Gamblers among this combination of items is 84% although the two four-item combinations that capture the highest proportions of Pathological and Problem Gamblers also capture 79% of the At-Risk Gamblers. Capture rates among the four-item combinations of two Behavior items and two Consequences items are lower than among the combinations that included the Motivation item (PPGM10) although many of these combinations capture 99% of the Pathological Gamblers and several capture 98% or more of the Problem Gamblers. Capture rates for At-Risk Gamblers are also lower among the Behavior-Consequences combinations. The two best performers in this group capture 99% of both the Pathological and Problem Gamblers as well as 76% of the At-Risk Gamblers. Finally, four of the eight combinations of three Behavior items and one Consequences item perform well and capture 80% of the At-Risk Gamblers in addition to 99% of the Pathological and Problem Gamblers.

The following table presents the most promising four-item combinations from the two samples. None of the four-item combinations that performed well in one sample were common across both surveys.

Table 14: Endorsement Rates for Four Item Combinations

	Internet Online			
	Recreational (N=2017)	At Risk (N=1538)	Problem (N=358)	Pathological (N=379)
PPGM10 + SOGS4 + PPGM8C + CPGI6	0.5	79.1	98.3	99.7
PPGM10 + SOGS4 + PPGM8C + CPGI8	3.9	79.4	98.3	99.7
CPGI3 + SOGS4 + CPGI6 + CPGI8	3.7	80.0	95.8	99.2
SOGS4 + PPGM8C + CPGI5 + CPGI8	3.9	76.1	99.2	99.5
SOGS4 + PPGM8C + CPGI7 + CPGI8	5.1	76.0	99.2	99.7
CPGI3 + SOGS4 + PPGM8C + CPGI8	4.0	83.9	99.2	99.5
	Best Practices			
	Recreational (N=1884)	At Risk (N=255)	Problem (N=36)	Pathological (N=18)
PPGM10 + SOGS4 + PPGM8C + CPGI7	1.0	62.4	100.0	100.0
PPGM10 + SOGS4 + PPGM8C + PPGM2	0.9	65.1	100.0	100.0
SOGS4 + PPGM8C + CPGI5 + PPGM2	0.9	62.7	100.0	100.0
CPGI3 + SOGS4 + PPGM8C + CPGI5	0.9	66.7	97.2	100.0

Among the Best Practices respondents, the capture rate for Pathological Gamblers is 100% for nearly all of the four-item combinations. Our focus therefore shifted to the capture rates for Problem and At-Risk Gamblers. None of the 84 combinations of one Motivation, one Behavior and two Consequences items capture more than 92% of the Problem Gamblers and most capture a much lower proportion. Similarly, none of these combinations capture more than 60% of the At-Risk Gamblers. Two of the four-item combinations of one Motivation item, two Behavior items and one Consequences item capture 100% of both the Pathological Gamblers and the Problem Gamblers although the capture rate for At-Risk Gamblers is under 70% for both of these combinations. As with the Internet Online sample, capture rates among the four-item combinations of two Behavior items and two Consequences items are lower among the Best Practices respondents than for combinations that include the Motivation item. One of these combinations, however, does capture 100% of both the Pathological Gamblers and Problem Gamblers as well as 63% of the At-Risk Gamblers. Finally, while all of the eight combinations of three Behavior items and one Consequences item capture 100% of the Pathological Gamblers and five of these combinations capture more than 95% of the Problem Gamblers, only one combination in this group captures more than 62% of the At-Risk Gamblers.

Five-Item Combinations

Finally, we examine the performance of several five-item combinations. Rather than consider all of the possible permutations, we focused on combinations that seemed most likely to yield high capture rates among the At-Risk Gamblers. These included seven combinations of one

Motivation item, two Behavior items and two Consequences items as well as eight combinations of one Motivation item, three Behavior items and one Consequences item.

Among the Internet Online respondents, all of the five-item combinations capture 99.7% of the Pathological Gamblers, 98% or more of the Problem Gamblers and 80% or more of the At-Risk Gamblers. The combinations that include one Motivation item, three Behavior items and one Consequences item capture higher proportions of At-Risk gamblers.

Table 15: Endorsement Rates for Five Item Combinations

	Internet Online			
	Recreational (N=2017)	At Risk (N=1538)	Problem (N=358)	Pathological (N=379)
PPGM10 + CPGI3 + SOGS4 + PPGM8C + CPGI5	0.6	89.0	98.9	99.5
PPGM10 + CPGI3 + SOGS4 + PPGM8C + CPGI8	4.0	88.6	99.2	99.7
	Best Practices			
	Recreational (N=1884)	At Risk (N=255)	Problem (N=36)	Pathological (N=18)
PPGM10 + CPGI3 + SOGS4 + PPGM8C + CPGI5	0.9	75.7	97.2	100.0
PPGM10 + CPGI3 + SOGS4 + PPGM8C + CPGI7	1.0	69.4	100.0	100.0
PPGM10 + CPGI3 + SOGS4 + PPGM8C + PPGM2	0.9	71.8	100.0	100.0

Among the Best Practices respondents, all of the five-item combinations capture 100% of the Pathological Gamblers, 97% or more of the Problem Gamblers and 64% or more of the At-Risk Gamblers. Four of the five-item combinations capture 100% of both the Pathological Gamblers and Problem Gamblers; however, these combinations tend to capture slightly lower proportions of At-Risk Gamblers.

Capture Rates of the Brief Screen Candidates

The table on the following page presents capture rates for the best candidates from the two-item, three-item, four-item and five-item analyses. The item combinations were selected on the basis of their ability to capture large proportions of Pathological, Problem and At-Risk Gamblers in both the Internet Online and the Best Practices samples.

The two-item combination includes items assessing Motivation and Behavior. One three-item combination includes two Behavior items and one Consequences item while the other consists of the three Behavior items. The four-item combinations represent differences in dimensionality, with one combination that includes a Motivation item, two Behavior items and a Consequences item, one combination that includes two Behavior items and two Consequences items, and one combination that includes three Behavior items and one Consequences item. The five-item combination includes a Motivation item, three Behavior

items and one Consequences item. The table presents capture rates for the combined Internet Online and Best Practices data sets.

The table shows that all of the candidate combinations except the two-item combination capture 99% or more of the clinically-assessed Pathological Gamblers in the combined Internet Online and Best Practices samples. Similarly, all of the candidates except the two-item combination and the three-item Behavior combination capture 98% or more of the clinically-assessed Problem Gamblers. Generally, capture rates for At-Risk Gamblers increase as the number of items increases although the three-item Behavior combination performs well in this regard and, in the four- and five-item combinations, PPGM10 adds substantially to the capture rate for At-Risk Gamblers. Capture rates for Recreational Gamblers are affected significantly by inclusion of CPGI8 (which asks whether a person’s gambling has been criticized by others).

Table 16: Endorsement Rates for Brief Screen Candidates

	Recreational (N=3923)	At Risk (N=1805)	Problem (N=397)	Pathological (N=398)
PPGM10 + SOGS4	0.1	65.6	83.6	96.7
SOGS4 + PPGM8C + CPGI8	2.7	70.6	98.2	99.5
CPGI3 + SOGS4 + PPGM8C	0.8	77.5	96.7	99.0
PPGM10 + SOGS4 + PPGM8C + CPGI6	0.7	77.0	98.2	99.7
SOGS4 + PPGM8C + CPGI7 + CPGI8	3.4	72.9	99.2	99.7
CPGI3 + SOGS4 + PPGM8C + CPGI8	2.8	80.5	99.0	99.5
PPGM10 + CPGI3 + SOGS4 + PPGM8C + CPGI5	0.8	87.1	98.7	99.5

Classification Accuracy of the Brief Screen Candidates

Classification accuracy is a statistical measure of how well a test performs in correctly identifying or excluding a condition. Classification accuracy is helpful in comparing how well, or poorly, different combinations of items perform in relation to the underlying condition of clinically-assessed problem gambling. The following table presents information about the classification accuracy and other performance metrics of the item combinations whose capture rates in the two samples were presented above. The table presents these results for the combined Internet Online and Best Practices data sets.

Table 17: Classification Accuracy of Brief Screen Candidates

	Sensitivity	Specificity	PPV	NPV	Classification Accuracy
PPGM10 + SOGS4	73.1	99.9	99.7	84.9	89.2
SOGS4 + PPGM8C + CPGI8	79.2	97.3	95.1	87.6	90.1
CPGI3 + SOGS4 + PPGM8C	83.7	99.2	98.6	90.2	93.1
PPGM10 + SOGS4 + PPGM8C + CPGI6	83.7	99.3	98.8	90.2	93.1
SOGS4 + PPGM8C + CPGI7 + CPGI8	81.0	96.6	94.1	88.5	90.4
CPGI3 + SOGS4 + PPGM8C + CPGI8	86.2	97.2	95.4	91.4	92.8
PPGM10 + CPGI3 + SOGS4 + PPGM8C + CPGI5	90.8	99.2	98.7	94.2	95.9

The table shows that the two-item combination of PPGM10 (which assesses preoccupation) and SOGS4 (which assesses whether a person has gambled more than intended) has the highest rates of specificity and Positive Predictive Value. This means that the two-item combination produces the lowest rate of false positive results. However, the two-item combination also has the lowest rate of sensitivity (73%) which means that this combination is more likely than the other combinations to miss clinically-assessed Pathological, Problem and At-Risk Gamblers.

In contrast, the five-item combination of PPGM10, the three Behavior items and one Consequences item (CPGI5 asks whether a person has borrowed money or sold anything to get money to gamble) has the highest rate of sensitivity as well as the highest Negative Predictive Value and the highest classification accuracy. The five-item combination also has good specificity although this metric is not the highest among the selected combinations. Based on this analysis, it is clear that the five-item combination is the best brief problem gambling screen in relation to these two large, clinically-assessed samples.

Performance of the Brief Screen Candidates by Gender, Age and Ethnicity

We noted above that in developing a brief screen for use in population research, it is important to select items that perform well across important subgroups in the population. In assessing measurement invariance, as this property is called, it is helpful to consider how well the candidate combinations perform across gender, age groups and ethnic groups.

We looked at the capture rates for men and women, three age groups (18-24, 25-44 and 45 and over) and three ethnic groups (European, Asian and Other/Refused) for the five candidate combinations. We found that the two-item combination captured fewer male Problem and At-Risk Gamblers, fewer Problem and At-Risk Gamblers under age 25 and fewer Asian Pathological, Problem or At-Risk Gamblers relative to other groups. The three-item combination captured fewer male At-Risk Gamblers and more At-Risk Gamblers aged 45 and over. The first four-item combination (1 Motive, 2 Behavior, 1 Consequence) captured fewer male Problem and At-Risk Gamblers, fewer Problem and At-Risk Gamblers under age 25, fewer European Problem Gamblers and more Other/Refused At-Risk Gamblers. The second four-item combination (2 Behavior, 2 Consequence) captured fewer male At-Risk Gamblers and more male Recreational Gamblers as well as more At-Risk Gamblers aged 45 and over relative to other groups. The third four-item (3 Behavior, 1 Consequence) captured fewer male At-Risk Gamblers as well as fewer Asian At-Risk Gamblers but more At-Risk Gamblers aged 45 and over relative to other groups. Finally, the five-item combination captured slightly fewer male Problem and At-Risk Gamblers as well as slightly fewer Problem Gamblers under age 25 relative to other groups.

Given these results, we chose to focus once again on the five-item combination with regard to classification accuracy across different demographic groups. The following table shows that the five-item combination has slightly better sensitivity and accuracy among women compared with men. The five-item screen performs uniformly well across three different age groups although Positive Predictive Value is somewhat lower among respondents under age 25 compared with other respondents. Finally, both sensitivity and specificity are slightly higher among Asian respondents in the two samples compared with Europeans and those classified as Other/Refused.

Table 18: Classification Accuracy of Five Item Screen by Demographic Group

	Sensitivity	Specificity	PPV	NPV	Classification Accuracy
Male	89.4	99.2	98.8	92.6	95.0
Female	93.0	99.3	98.6	96.1	97.0
18 – 24	90.0	98.2	95.9	95.4	95.6
25 – 44	90.6	99.3	98.7	94.8	96.1
45 and over	90.9	99.4	99.2	93.6	95.8
European	90.4	99.2	98.6	94.3	95.8
Asian	92.8	99.5	99.0	95.7	96.9
Other/Refused	91.5	99.1	99.1	92.1	95.3

Discussion

The present study uses data collected in two surveys that included all of the most widely used problem gambling screens and classified respondents based on clinical assessments. The sample includes over 7,000 North American gamblers. The 30 unique problem gambling items were sorted into three dimensions (gambling motivations, behaviors and consequences) and the items most closely correlated with the clinically-assessed At-Risk, Problem and Pathological Gamblers in the two surveys and capturing 50% or more of the Pathological Gamblers and 5% or less of the Recreational Gamblers were identified.

Once the candidate items in the two surveys were identified, the performance of all two-item, three-item, four-item and five-item combinations was examined to assess capture rates in each sample. All combinations that captured 98% of the Pathological Gamblers, 94% of the Problem Gamblers and 80% of the At-Risk Gamblers were considered eligible for further investigation. This consisted of determining the classification accuracy of the most promising combinations of items. Each of the promising combinations was then further examined for its performance across gender, age and ethnicity to assess the level of measurement invariance associated with each combination.

Based on performance across both surveys and measurement invariance across major demographic groups, a combination of five items including one motivation item, three behavior items, and one consequences item was identified as the best brief screen for clinically-assessed at-risk, problem and pathological gambling. In contrast, the performance of item combinations that best represented other brief problem gambling screens developed in recent years was unsatisfactory. This underscores the importance of assessing the performance of brief screens in relation to clinical assessments rather than in relation to the longer screens from which they are derived.

Limitations

There are some limitations to keep in mind in considering the results of this study. One issue is that all of the respondents in the two samples are from North America. Only 848 respondents from the Internet Online sample come from outside North America and these respondents have both a significantly higher rate of non-gambling and a significantly higher rate of pathological gambling than the North American respondents. It is possible that our newly-developed brief problem gambling screen will perform differently among respondents from countries outside of North America. While it is possible to examine this question with the small sample of non-North American respondents from the Internet Online study, it would be preferable to conduct these analyses with a much larger sample of non-North American gamblers.

Another limitation is that, for the most part, the respondents in the Internet Online and Best Practices samples had to be examined separately because of the significant differences in

demographic characteristics and problem gambling prevalence rates in the two studies. However, many clinical studies in the gambling studies field, and in the addictions field more generally, rely on far smaller samples than the groups investigated here.

Another possible limitation is that the performance of the individual problem gambling items may have been affected by the need to administer all of the CPGI items first rather than randomizing administration of all four problem gambling screens included in the studies. Certainly, the results of the factor analysis that we conducted to assess the dimensionality of the 30 problem gambling items suggests this. However, since three of the five items in the final combination of items are not from the CPGI, this does not appear to have been a major limitation to the present study.

Conclusions

This study had the goal of identifying the smallest set of items from a larger set that included all of the most widely-used problem gambling screens that would capture at-risk, problem and pathological gamblers in population surveys. The present study is unique in using clinically-assessed respondents from two large population surveys as the “gold standard” against which to judge the performance of different combinations of items, rather than relying on the longer, problem gambling screen from which the items are drawn.

Our analysis leads to several conclusions. First, endorsement rates for individual items as well as problem gambling prevalence rates differ substantially across the Internet Online and the Best Practices samples and across major demographic groups in each study. However, experience suggests that it is not practical to develop different problem gambling screens for different demographic groups or study populations. Instead, we have focused on identifying the smallest set of items that would operate well across different samples and across different demographic groups within those samples.

Second, we found that combinations of items intended to closely approximate several existing brief problem gambling screens perform poorly in relation to the clinically-assessed groups in our study. For example, the two items in our datasets that most closely approximate the Lie-Bet Screen captured only 88% of the Pathological Gamblers in the Internet Online sample and only 78% of the Pathological Gamblers in the Best Practices sample. This finding suggests that more work is needed to assess the performance of these brief problem gambling screens in relation to other clinically-assessed samples as well as in relation to treatment-seeking problem gamblers.

Third, we found that the final set of five items that captured the largest proportions of At-Risk, Problem and Pathological Gamblers included three Behavior items in addition to one Motivation item and one Consequences item. Indeed, the three Behavior items alone captured

99% of the Pathological Gamblers and over 95% of the Problem Gamblers although this combination did not capture 80% or more of the At-Risk Gamblers. Furthermore, the three-item Behavior combination performs nearly as well as the candidate four-item combinations in terms of specificity although it has lower sensitivity and classification accuracy than the five-item combination. This indicates that there may be merit, as Maitland and Adams (2005) have suggested, in developing separate problem gambling screens for problem gambling behaviors and problem gambling consequences. Given the impact of the one Motivation item in this study, as well as the dearth of such items in any of the most widely-used problem gambling screens, there may also be value in developing screening tools to assess gambling motivations in more detail.

Fourth, it is possible that the three-item Behavior combination would be a good candidate to test for performance in clinical settings while the five-item combination is the better candidate to test for performance in population research. The five-item combination is attractive in population research because, while the five items would be administered to all gamblers, only those who endorse one or more of these items (representing a relatively small proportion of a population survey sample) would need to be routed through one or another of the longer, standard problem gambling screens.

Future Directions

The work reported here is intended to form the foundation for a full-scale test of the validity, reliability and classification accuracy of the new set of items. Future directions in this research effort should also include:

- further exploration of the experiences of women Internet gamblers who, in contrast to women in the general population, are more likely to endorse most problem gambling items than male Internet gamblers;
- further exploration of problem gambling items to determine the smallest subset that would be effective in clinical settings (i.e., not capturing At-Risk Gamblers but only Problem and Pathological Gamblers); and
- further investigation of the factor structure of gambling-related problems as well as investigation of the possibility of developing gambling scales that focus separately on

Behavior and Consequences as well as further exploration of new gambling Motivation items.⁴

To conclude, we have noted elsewhere that work is needed to examine the underlying conceptualization of problem gambling (Volberg & Young, 2008). While this report has focused on identifying a number of candidates for a brief screening test for problem gambling in relation to two large samples of clinically-assessed gamblers, the analysis has also contributed to our understanding of the conceptual underpinnings of the problem gambling construct. We believe that this analysis will be of interest to researchers and clinicians working with problem and pathological gamblers. We also believe that this analysis will contribute to improvements in the measurement of problem gambling and its harms.

⁴ Work in this area has been undertaken recently by Stewart and colleagues (Stewart, Zack, Toneatto, Turner, & Grant, 2008) as well as by the National Centre for Social Research in preparation for the 2010 British Gambling Prevalence Survey.

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**APPENDIX A:
PROBLEM GAMBLING ITEMS, LABELS AND CONTENT AREAS**

Item Label & Coverage				Content Area
CPGI1				Bet more than could afford
CPGI2	SOGS6			Felt guilty about gambling
CPGI3		PPGM11	NODS2	Tolerance – needed to gamble with larger amounts to get same excitement
CPGI4	SOGS1	PPGM8B	NODS6	Chasing – go back often another day to win back money
CPGI5		PPGM1A	NODS10	Borrowed money or sold anything, obtained a bailout
CPGI6		PPGM1B		Gambling caused financial problems
CPGI7				Gambling caused health problems
CPGI8	SOGS5			People criticized your gambling
CPGI9	SOGS3			Have a problem with gambling
	SOGS2			Claimed to win when losing
	SOGS4	PPGM8A		Often gambled longer, more money, more frequently than intended
	SOGS7			Would like to stop
	SOGS8			Hidden evidence of gambling
	SOGS9	PPGM3A	NODS9A	Arguments over handling money
	SOGS10			Borrowed and not paid back
	SOGS11	PPGM5	NODS9B+C	Missed time from work or school
	SOGS12			Borrow money to gamble or pay gambling debts
		PPGM2		Gambling caused significant mental stress for you or someone close to you
		PPGM3B		Gambling caused neglect of children or family
		PPGM4		Gambling caused significant health problems for you or someone close to you

Item Label & Coverage				Content Area
		PPGM6	NODS8	Gambling caused you to commit illegal acts
		PPGM7		Anyone else who would say your involvement in gambling has caused significant concerns for you or someone close to you
		PPGM8C	NODS3A	Attempts to cut down, control or stop gambling
		PPGM8D	NODS4	Successful in attempts (NO)
		PPGM9	NODS3B	Withdrawal - restless or irritable when trying to cut down or stop
		PPGM10	NODS1A+B	Preoccupied
		PPGM12		Anyone else who would say you were preoccupied, had a loss of control or withdrawal symptoms, or needed to gamble with larger amounts to achieve same excitement
			NODS5A	Gamble to escape personal problems
			NODS5B	Gambled to relieve uncomfortable feelings
			NODS7	Lied to others about your gambling

APPENDIX B: DEFINITIONS OF PROBLEM GAMBLING CATEGORIES

Problem Gambler

The definition of problem gambling put forward by Neal et al. (2005) captures the essential elements of this phenomenon common to almost all definitions:

“PROBLEM GAMBLING is characterized by difficulties in limiting money and/or time spent on gambling which leads to adverse consequences for the gambler, others, or for the community.”

Diagnostically, what this definition means is that to be a problem gambler there has to be evidence of: (a) impaired control over gambling behavior, and (b) adverse consequences deriving from this impaired control. Furthermore:

- Impaired control is something that occurs repeatedly.
- Adverse consequences have to be “significant”. A “significant consequence” is a problem that either the person themselves or someone else would say is considerable, important, or major, either because of its frequency or seriousness. A “problem” is a state of difficulty that needs to be rectified.
- Loss of control and adverse consequences are identified either by self-admission; endorsement of statement(s) *indicative* of loss of control and/or adverse consequences; and/or objective evidence of these things.
- A person cannot be a problem gambler unless he/she also reports some minimal amount of time, frequency or money spent gambling in the time frame in which he/she is reporting loss of control and adverse consequences.
- Person does not meet criteria for pathological gambling.

Pathological Gambler

The term “pathological gambler” tends not to be used in some countries (e.g., Canada, Australia, New Zealand) because of its dichotomous implications⁵ and because of its medical and etiological connotations (i.e., “pathological” means “disease-like”). On the other hand, (a) severe forms of problem gambling are very compulsive and disease-like, (b) the term pathological gambling is still commonly used in many countries, and (c) pathological gambling continues to be the formal designation in DSM-IV. Hence, “pathological gambling” and “severe problem gambling” should be seen as equally legitimate and interchangeable terms.

“PATHOLOGICAL GAMBLING is equivalent to SEVERE PROBLEM GAMBLING and is characterized by severe difficulties in controlling gambling behavior leading to serious adverse consequences”.

⁵ Evidence indicates that disordered gambling lies on a continuum.

Essentially, the criteria for pathological gambling are the same as problem gambling except there is greater impaired control and more severe consequences. These consequences may be more severe either because they impact more areas (financial, psychological, health, relationship, school/work, legal) and/or because the problems are more serious.

At Risk Gambler

“An AT-RISK GAMBLER is someone who is at risk for becoming a problem or pathological gambler because:

- a) they evidence some adverse consequence(s) from gambling but no symptoms of loss of control; OR*
- b) they evidence some symptoms of loss of control but no adverse consequences; OR*
- c) they evidence some adverse consequences and loss of control, but not at a level sufficient to meet criteria for problem or pathological gambling; OR*
- d) they have a gambling frequency and/or expenditure that is significantly above average (especially in the context of their employment status, income, and debt).*

Recreational Gambler

“A RECREATIONAL GAMBLER is someone who gambles without meeting criteria for AT-RISK, PROBLEM, or PATHOLOGICAL Gambling.”

Time Frames

The time frames for these categorizations can be past year or lifetime.

APPENDIX C: DIMENSIONALITY OF PROBLEM GAMBLING ITEMS

Motivations	Behavior	Consequences
PPGM10. Preoccupied	CPGI1. Bet more than could afford	CPGI2. Felt guilty about gambling
NODS5A. Gamble to escape personal problems	CPGI3. Tolerance – needed to gamble with larger amounts to get same excitement	CPGI5. Borrowed money or sold anything or obtained a bailout
NODS5B. Gambled to relieve uncomfortable feelings	CPGI4. Chasing – go back often another day to win back money	CPGI6. Gambling caused financial problems
	SOGS2. Claimed to win when losing	CPGI7. Gambling caused health problems
	SOGS4. Often gambled longer, more money, more frequently than intended	CPGI8. People criticized your gambling
	SOGS7. Would like to stop	CPGI9. Have a problem with gambling
	SOGS8. Hidden evidence of gambling	SOGS9. Arguments over handling money
	PPGM8C. Attempts to cut down, control or stop gambling	SOGS10. Borrowed and not paid back
	PPGM8D. Successful in attempts (NO)	SOGS11. Missed time from work or school
	PPGM9. Withdrawal - restless or irritable when trying to cut down or stop	SOGS12. Borrow money to gamble or pay gambling debts
		PPGM2. Gambling caused significant mental stress for you or someone close to you
		PPGM3B. Gambling caused neglect of children or family
		PPGM4. Gambling caused significant health problems for you or someone close to you

Motivations	Behavior	Consequences
		PPGM6. Gambling caused you to commit illegal acts
		PPGM7. Anyone else who would say your involvement in gambling has caused significant concerns for you or someone close to you
		PPGM12. Anyone else who would say you were preoccupied, had a loss of control or withdrawal symptoms, or needed to gamble with larger amounts to achieve same excitement
		NODS7. Lied to others about your gambling

**APPENDIX D:
BRIEF PROBLEM GAMBLING SCREEN**

PPGM10	In the past 12 months, would you say you have been preoccupied with gambling?
CPGI3	In the past 12 months, have you needed to gamble with larger amounts of money to get the same feeling of excitement?
SOGS4	In the past 12 months, have you often gambled longer, with more money or more frequently than you intended to?
PPGM8C	In the past 12 months, have you made attempts to either cut down, control or stop gambling?
CPGI5	In the past 12 months, have you borrowed money or sold anything to get money to gamble?